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New Challenges for a New Era

Progress Through Innovation, Education and Research in North Carolina

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Final Report
of the
Governor's Task Force on Science and Technology

VOLUME I
A VISION OF OPPORTUNITY

N.C. Board of Science and Technology
Office of the Governor
Raleigh, North Carolina
January, 1984

NEW CHALLENGES FOR A NEW ERA

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STATE OF NORTH CAROLINA
OFFICE OF THE GOVERNOR
RALEIGH 27611

JAMES B. HUNT, JR.
GOVERNOR

January, 1984

Governor James B. Hunt, Jr.
The State Capitol
Raleigh, North Carolina

Dear Governor Hunt:

The Governor's Task Force on Science and Technology has completed its 15-month study and hereby submits its final report. The report focuses on the state's economy, and the contributions of innovation, education and research to economic development. The report is an appropriate follow-up to the NC 2000 study, and a compelling argument in favor of more substantial investments -- human and financial -- in education, training, research, and economic revitalization. We ask that you urge the citizens of North Carolina to begin taking steps now to address the issues set forth in this report.

We believe the report is unique in its scope and coverage of the issues:

- It is based on the premise that North Carolina is experiencing sweeping changes in its social, economic, cultural and political systems, and those changes are largely driven by advances in science and technology. Virtually everywhere we turn a new scientific advance is influencing our lives. Computers have become vital tools for some at home and for many at work. Advances in fields such as biotechnology and microelectronics may enable us to live longer and healthier lives, increase food production, and shorten the work week.

- It recognizes that these changes cannot be avoided, but many can be harnessed and guided for society's benefit. There are some changes in our lives that cannot be "turned back," others which lie ahead that cannot be postponed. But most of these technology-driven changes can be directed one way or another. The challenge is to make science and technology work for the benefit of all citizens.

- It focuses on how we can apply the potential of science and technology to provide North Carolinians with more productive and rewarding jobs, access to better educational opportunities, a healthier environment and, in general, an improved quality of life. Scientific knowledge gives us the power to make changes in our lives, but science itself does not give us the wisdom to make the right choices. As we experience this transformation of society, our decisions on how best to apply technological advances must be guided by such principles as justice, equity, compassion and full participation. This report reflects the influences of these guiding principles.

- It recognizes the need, especially in light of the potentially strong forces of scientific and technological change, to encourage and support education, research and creative endeavors in the humanities and the arts. The humanities and arts are our major cultural resources for defining, integrating, empowering, and directing our lives as individuals and as a society. Attention to scientific advance must also recognize the need to incorporate the wisdom of the humanities and the vision and inspiration of the arts into public policy decisions.

- Its recommendations are targeted at specific institutions in our society, for through these institutions we make decisions on how to guide the potential of science for societal well-being. These institutions include elementary and secondary schools, colleges and universities, all levels of government, private business and labor, community groups and other organizations. These institutions establish the manner in which our society functions -- through laws, regulations, policies, practices and traditions. The intent is not simply to determine the direction of the science itself but, in addition, to influence the responses of our institutions to the changes in society that are driven by science.

This report represents a comprehensive strategy for confronting the challenges of a changing society. It does not cover all of the issues, leaving to other groups the substantial study of matters such as health, environmental management and transportation. Likewise, the role of the humanities and the arts in a changing society is left to others to develop.

If North Carolina is to reach its full potential as a prosperous state -- where all citizens can enjoy more rewarding personal and professional experiences -- the state must begin now to mobilize and commit all its resources to meeting these challenges.

We look forward to working with you in carrying out our recommendations.

Sincerely,

Members of the Governor's
Task Force on Science and
Technology

ACKNOWLEDGEMENTS

Task Force members wish to express their appreciation to the hundreds of persons who contributed to this study, particularly associate committee members, regional forum participants, and state government personnel.

The Task Force was staffed by four persons who contributed to all facets of Task Force activities and drafted the final report. Tom Rudin was the principal author of Volume I; Kirsten Nyrop, Volume II; Shannon St. John, Volume III; and Sanford Shugart, Volume IV.

Task Force members and staff are extremely grateful to Brenda Pennington, Gail Whitaker, Ann Cooper, Linda Cox, Beverly Horne, Paul Price, Cathy Peeler, Ron Ennis and Leon Neal, for their dedicated commitment and various contributions to the Task Force effort. Special appreciation is extended to Don Phillips, Director of the N.C. Biotechnology Center, for his assistance. A number of interns and fellows also had important roles in the work of the Task Force.

TITLES OF EACH VOLUME

Volume I - A Vision of Opportunity

Volume II - Economic Revitalization Through Technological Innovation

Volume III - Research and Higher Education: Building a Foundation for Education

Volume IV - Public Education and the Technological Challenge

Supplemental reports have been prepared by the Task Force's Committees on Agriculture and Forestry, N.C. and the World Community, and Science, Technology and Human Values.

All four volumes and copies of the supplemental reports can be obtained upon request from:

Office of the Governor
Administration Building
Raleigh, NC 27611
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PREFACE

The Governor's Task Force on Science and Technology began its work in September, 1982 with the following goal: To evaluate the state's scientific and technological resources and recommend policies, procedures, organizational structures and financial requirements necessary to enable the people of North Carolina to realize additional economic and social benefits from the proper use of our scientific and technological resources. Governor Hunt appointed 32 persons to the Task Force, adding 17 persons to the existing 15-member North Carolina Board of Science and Technology. Task Force members represent state and local government, business, labor, higher education, elementary and secondary education and the citizens of North Carolina.

During its tenure, the Task Force undertook several activities to enhance its efforts:

- Established three major committees: Technological Innovation, Research and Higher Education, and Elementary and Secondary Education. In addition to Task Force members, committee membership included experts from various sectors of North Carolina society and from all parts of the state.

- Created four special working committees to supplement the work of the major committees: Long-Term Program Support; North Carolina and the World Community; Agriculture and Forestry; and Science, Technology and Human Values. These special committees also drew heavily on non-Task Force members for input and expertise.

- Sponsored five regional forums on science and technology, in Greenville, Charlotte, Greensboro, Wilmington, and Asheville. The forums enabled Task Force members to exchange ideas about local issues with citizens at the local level.

- Worked with other state government and education agencies to sponsor programs on small business innovation, mathematics and science education, and the role of the humanities in public policy issues.

- Worked for passage of legislation creating the North Carolina Technological Development Authority, establishing new initiatives to strengthen science and mathematics education, and establishing expanded research programs in biotechnology and environmental management.

This four-volume report represents the culmination of the Task Force effort. Volume I provides an introduction and overview of the major issues considered by the Task Force. Volumes II, III and IV were essentially drafted by the Committees on Technological Innovation, Research and Higher Education, and Elementary and Secondary Education, respectively. The special working committees contributed to all four volumes, and three of those committees -- N.C. and the World Community, Agriculture and Forestry, and Science, Technology and Human Values -- published supplemental reports.

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A VISION OF OPPORTUNITY

INTRODUCTION

During the 1700s colonists discovered a new opportunity to provide cheaper housing for themselves and their children. Sawmills had become so efficient that it was more versatile and economical to build frame houses than log cabins. Increased mobility and growth of larger industries encouraged the crowding of these frame houses into what became America's first cities. Cleverly conceived fireplaces, stoves and warming pans made life more comfortable. Technological triumphs had pioneered the way to a new style of living in a new land.

All was not well, however. The packed housing, and the way homes were heated, created a fearful peril for the colonists -- the great potential for devastating fires. As if the colonists hadn't enough problems, a new threat had emerged.

In several of his letters and essays, Benjamin Franklin expressed concern about fires. To counter this problem, Franklin proposed structural modifications in the houses. He proposed the licensing and supervision of chimney sweeps, and promoted the notion of well equipped volunteer fire departments. He invented the lightening rod. In short, he devised new technologies to confront the problems created by other new technologies.[1]

For some people, technology remains something distant and aloof -- perhaps something to be feared and avoided. Technology is seen as a challenge, but not as an opportunity. The computer-controlled weaving device at a textile plant may be a tremendous vehicle for increasing productivity -- as seen by the plant manager. But to the 45-year-old worker who knows no skill other than working the shuttle looms by hand, the same technological breakthrough threatens to throw into disarray what had been a rewarding life for him and his family.

Most of us have accepted the introduction of new technologies into our lives, and the sweeping changes in our society which have resulted. Frequently we accepted them not because we sought them out, but because they were thrust upon us by forces over which we had little control. Only a handful of persons made the decisions to install automatic teller machines which have sprung up across the country. Certainly the $3.35-an-hour laborer does not have control over whether he or she should be replaced by a robotic arm. Only a few citizens are involved in controlling the use of nuclear power -- for peaceful purposes and otherwise. We have grown accustomed to accepting change, especially technologically-driven change, often because we perceive there to be little opportunity to do anything _but_ accept it.

With this apprehension, though, there has developed a sense of anticipation. Our society does hold high expectations for technological advances. We have apparently postponed any direct confrontation with the world's limited energy supply because we anticipate new technological breakthroughs in this area. We expect advances in the fields of biology and chemistry to enable us to clean up our environmental wastes. We continue to look forward to the day when scientists "discover" a secure means for disposing of radioactive materials. So, amid the expressions of concern and disdain, people are looking to technological advance to relieve us of society's greatest woes.

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[1] Samuel C. Florman, "Living with Technology: Trade-Offs in Paradise," _Technology Review_, August/September 1981, p.30.

The unquestionable premise here is that science and technology[2] are the driving forces behind much of the transformation our society is experiencing. Technological advances will have an even greater influence on our lives in the years to come. Consider:

- In the last 20 years high technology has created 75 percent of the net employment growth in American manufacturing industry. Over the next 20 years, high technology and the availability of energy resources will become the dominant factors in our economy.

- Despite the expected increase in the number of more technological, more rewarding occupations, low-paying jobs with low skill requirements will still constitute a large part of the United States and North Carolina labor markets. By 1990, this country will need 60 percent more computer programmers, 80 percent more systems analysts, and 112 percent more computer service technicians. These percentages, however, translate into only 493,000 new jobs. By 1990 the U.S. will also need 750,000 new janitors, 470,000 new waiters and waitresses, and 262,000 more typists.

- The influence of both technological innovation in the workplace and international competition in the marketplace will be felt directly by the current labor force. Some project that these two factors will result in the elmination of 10 million jobs nationally during the next decade. In 1982 alone, these factors contributed to the closing of 27 textile plants in North Carolina.

- Advances in high technology fields such as biotechnology and microelectronics are revolutionizing communications, commerce, and health care. As an example, scientists are experimenting with devices which, when implanted in the human brain, could enable people to control their automobile or airplane by merely thinking a command.

- The requirements for quality education and training to meet the demands of the labor force are unprecedented. Unfortunately, our institutions of higher education are not meeting these demands. The United States will require 113,500 more electrical engineers and computer scientists in the next five years than will graduate from its colleges and universities. Soon, more than two-thirds of our

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[2] In this report, the terms "high," "advanced" and "new" technology will be used interchangeably to refer to forms of technological innovation. "High" technology is generally used in conjunction with such industries as telecommunications, microelectronics and biotechnolgy. But technological innovation is not limited to these new industries; technological advance also includes change in traditional industries. The preferred term, therefore, is "new" technology.

> total workforce may need some type of higher education experience in technical fields. And all our citizens need to achieve a basic scientific literacy if they are to function responsibly in our democratic society.

Clearly science and technology have become dominant concerns in our society. They affect virtually every aspect of our lives in one way or another. For each of us, the question becomes not whether we want change, but how to cope with it when it comes.

Responsibilities

It has become convenient for scientists of all types -- natural, physical, social, political -- to speak of the potential benefits of technological advance in terms of statistics. We can predict with some confidence the number of jobs and the total amount of tax revenues a new, high-technology enterprise will create in North Carolina. We can estimate the number of additional scientists, electrical engineers, computer technicians, and support personnel our schools must train for every new firm located in the state.

Now our interest must extend beyond purely quantitative measures to a consideration of the various effects of technology on all our citizens -- including our experiences as individuals and as members of the larger society. We have begun to look beyond job creation and measure the impact of high technology on:

- schools -- will we train persons for specific technological jobs only, or educate them for a full, rewarding life as well?
- communities -- will rapid population growth place too great a burden on our water, sewer and transportation systems?
- the environment -- what new environmental hazards are associated with highly sophisticated chemical, biological and electronic manufacturing processes?
- the labor force -- how many workers will be displaced, and what is society's obligation to them?

It has also become clear that, despite the potential of technology to solve a number of problems, it is not likely that any technology will "fix" something entirely. The problems may simply change in their nature. For example, when we suggest that advances in biotechnology could prolong life, an entirely new set of problems arises -- increased illness and new economic burdens associated with a more elderly population, as well as, perhaps, a redefinition of the family structure. The point is that each new technological solution may, in turn, create new issues which will also require attention.

Our society has also begun to recognize the need to explore how technological changes will affect the economic, political and social status of individuals in relation to each other. Can we ensure, for example, that we will remain a democratic society as we move further into this new technology era? Consider the statement of Clifton R. Wharton, Chancellor of the State University of New York:

> More and more people use modern technology while fewer (relatively speaking) understand how it works. Instead, we are content to be served by cadres of technicians and specialists and, thereby, to cede to them an inordinate, even ominous amount of control over our lives. The great mass of people, including many college graduates, are at least arguably in danger of becoming what a recent rather inflammatory book called "technolpeasants": modern-day serfs, nominally free but disenfranchised by ignorance--and fear--of prevailing technologies.

A healthy society is one in which participation is broad, so that all citizens contribute to decision-making. We must ensure that throughout this transformation a sense of justice prevails; that the integrity of government, institutions, economic firms and other units of society is maintained and respected.

At a more basic level we need to explore the options created by the sciences themselves. Ultimately the decisions on how we apply scientific breakthroughs are guided by the values and beliefs of individual citizens, not just by science. Some contend, for example, that we are currently at the same developmental stage in the field of biotechnology that we were at during the early 1940s in the development of nuclear technology. Should we not plan to be more responsible in managing the development and application of biotechnology during the next 40 years than we have been in managing our nuclear capabilities during the last 40?

The Required Response

Changes brought about by scientific and technological advances are complex. They require us to look beyond the common framework within which North Carolina society now functions. Indeed, many of our traditional modes of operation may have to be re-examined:

- We must substantially upgrade the education of all our citizens, especially in science and mathematics. Our goals are to increase access to education for all North Carolinians and at the same time make education more demanding and rigorous. To do so, however, requires fundamental changes in our traditional education systems. Change in education comes hard.

- We must be prepared to provide short-term, intensive retraining opportunities for the thousands of skilled and unskilled workers who will be displaced by new innovations in the workplace. The potential for the polarization of society between those who prosper from technological advance and those who suffer from its influences is significant. Business, labor, government and educational institutions will have to work together to meet the increasingly specialized needs of individual workers and prevent the emergence of a two-class society of technological "haves" and "have-nots."

- We must encourage our most talented researchers and educators to extend themselves and explore new frontiers of science. At the same time, all our citizens must be prepared to direct the application of science for the benefit of humanity, rather than for its degradation or destruction.

- In addition to recruiting new industries and stimulating the development of indigenous firms in North Carolina, we must emphasize innovation in our traditional industries. Traditional industries will continue to shoulder the burden of maintaining the State's economic strength -- and will continue to provide a substantial portion of our jobs -- making their survival essential.

- Among its several health and welfare agencies, medical facilities, and public safety and criminal justice organizations, North Carolina possesses great institutional capabilities to enhance the health and well-being of all its citizens. These capabilities, however, are not yet fully extended to all citizens such that health care, welfare and public safety are at their highest standards at reasonable cost. Programs must be developed which ensure that research and development advances in human resource fields are translated into improved well-being for all North Carolinians, without continuous escalation of costs. As the state's population continues to grow, particular attention must be given to the special needs of the elderly, the physically and mentally handicapped, and emotionally disturbed citizens.

- Government must take the lead in fostering a cooperative approach to social and economic development -- one where business, labor, education, government and the people work together to promote the highest level of personal and professional satisfaction among all citizens. Achieving this goal will require the tearing down of barriers which created traditionally adversarial relationships between many of these institutions, while at the same time preserving the checks and balances among them.

The Task Force

With this vision in mind, the Governor's Task Force on Science and Technology has completed an 15-month exploration of North Carolina society and the influence of science and technology on that society. Specifically, the Task Force was charged with developing recommendations for improving the quality of science and mathematics instruction in our elementary and secondary schools, strengthening the research and education components of our institutions of higher education, and encouraging technological innovation across all fields of commerce, education and research. The findings and recommendations herein address these points. The Task Force has gone one step further, however, and considered a broad range of societal issues within the context of scientific and technological influences.

This report represents a culmination of the Task Force effort. It asks North Carolinians to challenge their traditional views of education, training, research, and economic and social development, but only because the societal transformation brought about by technological advance demands such. It presents workable strategies for upgrading the economic, social and cultural vitality of the state. It offers a long-term, strategic program which will enable our society to adapt to not only new technologies but to grow and prosper by applying innovative ideas and processes.

Volume I of the report lays the foundation for the entire report. The purpose of Volume I is to relate science and technology to North Carolina society, and demonstrate how science and technology are the driving forces behind the current transformation. In addition, Volume I summarizes briefly what will follow in Volumes II-IV of the report.

Each of the subsequent volumes will set forth a comprehensive strategy to encourage economic revitalization through technological innovation (Volume II), strengthen research and higher education (Volume III) and improve science and mathematics instruction in elementary and secondary education (Volume IV).

THE CHANGING SOCIETY

The Transformation

One hundred years ago the "typical" worker in North Carolina was the farmer. Farmers' lives were dominated by their direct relationship to nature. They were dependent more on how they manipulated soil, fertilizer and seed than on the decisions made in a brokerage house board room. As this State experienced its version of the industrial revolution, the lives of North Carolinians took on new forms. During the first half of the 20th century more and more North Carolinians became manufacturers and producers. The textile industry, for example, grew and developed to the point that it became a dominant force in North Carolina's economy. Suddenly the relationship to nature was lost for many, replaced by a relationship to things, to equipment and supplies. North Carolinians -- some reluctantly -- moved into the cities and spent an increasing amount of time using their hands to work machines rather than working the ground.

North Carolina, as with the rest of the nation, is currently experiencing another social and economic transformation, one dominated by services, communication, increased mobility, and unprecedented medical breakthroughs. In the past, jobs depended more on physical capacities in working directly with the land and with machines. Today, jobs depend on new skills: a knowledge of communication processes, an ability to process data, an understanding of sophisticated pieces of equipment. Now a decision made by a banker in one corner of the world can have instant and far-reaching implications for businesses and governments everywhere. The driving force behind this transformation is technological advance, and it is bringing marked change to the structure of North Carolina society.

Forms of Transformation

One need only to examine the total lifespan of individuals, and how certain components of that lifespan are changing, to recognize that we are experiencing such a transformation. Consider the following examples.

1. Health/Social Services. Years ago, access to quality health care was limited to an elite few, with most families relying on "home remedies" for treatment. Now, however, due to both scientific advances and new institutional arrangements such as social security, health care is available in one form or another to virtually every citizen at any age. Fetuses can be tested and treated for disease while still in the mother's womb. Vaccines are available to people throughout life to ward off dreaded diseases which only 50 years ago killed thousands of Americans annually. New technologies can be used to prolong life. As an increasing percentage of our population becomes 65 or older (14 percent of N.C. citizens by 2000), new dilemmas will be confronted. Science and technology can provide the tools for upgrading health and social care. But the way our society responds, through institutional and organizational means, will determine whether we actually benefit from the potential for improved services.

2. Education. Educational systems relate to individuals at many levels: elementary and secondary schools for most, higher education institutions for many, and, increasingly, at career and retirement phases of life through adult training. The nature, scope and complexity of our education systems are changing. In Ben Franklin's day, most people were educated within the family, through apprenticeships and other informal means. Formal schooling was limited. Now, however, education through formal means has become a prerequisite to social and economic advance. As the workplace begins to make more demands on individuals to resolve complex problems, sufficient education and training will become even more critical. More people will attend school for an increasing segment of their lives than ever before. It is time to consider whether or not the traditional systems of education are sufficient to the new demands, and, if not, to devise innovative alternatives.

3. Economy. Predominantly economic organizations -- industrial and agribusiness firms, financial institutions, etc. -- provide employment, entrepreneurial and other opportunities through additional phases of the lives of people. But individuals no longer find "natural, virgin frontiers" readily available to conquer or exploit as they did 150 years ago. Frontiers now, for the most part, are the frontiers of innovative organization and service and product invention, all of which require individual knowledge, training and imagination, and which, in turn, require extensive institutional development and support.

4. Cultural, Religious and Social Institutions. These organizations are significant to the lives of individuals at various stages in life. They too are changing. It may be concluded that in the long-run it is the "culture" that molds and defines the fundamental characteristics of society. Cultural, religious and social institutions, however, appear to occupy a diminished status in relation to those institutions that embody scientific, engineering and technological pursuits. The question arises as to whether this is desirable.

5. Government. As population and all components of society have grown and changed, so has government grown and changed. Now, instead of being concerned just with law and order, property records, highways and other limited functions, as was the case a century ago, federal, state and local government units are involved in various ways with many aspects of society. Likewise, individuals influence, and are influenced by, government functions throughout their lives. Jefferson contended that the "best government is the least government." Perhaps the term "best" will have to be redefined today.

Only when we recognize that this transformation includes all components of our society can we understand that technological advance affects virtually every aspect of our individual lives. While it was not possible to encompass all facets or components of society in the work of the Task Force, this report does reflect an understanding of the broad societal impacts of technological advance. The Task Force concentrated on certain aspects of research and education, particularly scientific, engineering and technological aspects. Because of their importance in creating and maintaining jobs, roles or places for individuals in society, the focus was on certain forms of industrial enterprise (both product and service oriented), agriculture and agribusiness, financial institutions, and the other economic components of society as well as our educational systems. Other components were not considered in detail.

This is not because health service systems, cultural entities, and other facets of society are unimportant. Rather, limited resources forced the Task Force to direct attention primarily to economic matters, while making reference to social, cultural and other entities when appropriate. Individuals and organizations representing these other components are urged to come forward with comparable studies.

North Carolina's Economy

A snapshot of North Carolina may not give the impression of a state caught up in the whirlwind of unfettered change (see Table 1). While the state's rate of population growth during the past 20 years has been significant -- faster than any southern state except Texas and Florida -- North Carolina remains essentially rural. Even with rather dramatic changes in some of the rapidly growing high technology manufacturing sectors, 53 percent of the state's total manufacturing employment remains in four sectors: apparel, lumber and wood products, furniture and textiles. The comparable figure for the nation is only 16 percent. While North Carolina's average manufacturing wages increased from 68 percent of the national average in 1960 to 74 percent in 1980, these wages still rank the lowest of any state in the nation.

Yet the state has not been idle in its efforts to bolster economic development. Indeed, there has been a concentrated effort during the past ten years to create new jobs through industrial expansion and investment (see figure 1), In 1973, for example, 22,000 new jobs were created by industrial expansion; in 1981 that figure was 32,000. And while there was about $350 million of capital investment by new and expanding industries in 1973, there was nearly $2 billion worth of investments in 1981 (1982 dollars). The recent recession has slowed that growth temporarily.

There are even more tangible signs of North Carolina's pursuit of technological development. The state has invested more than $41 million in the Microelectronics Center of North Carolina to encourage joint university-industry research ventures in that field. The General Assembly recently passed the New Technology Jobs Act, which provides for "start-up" funds and incubator facilities for small businesses and funds for programs to foster joint industry-university research in biotechnology. The state has taken the first step toward correcting a serious deficiency in the area of scientific instrumentation, having provided more than $12 million to upgrade the research and education equipment of the state's community and technical colleges. In elementary and secondary education, the North Carolina School of Science and Mathematics was the first in a series of state initiatives to strengthen education in mathematics and science.

North Carolina has begun its journey toward social and economic prosperity through technological innovation. It has made some initial investments. Its work, however, is just underway.

Table 1

NORTH CAROLINA AT A GLANCE

Population, 1980 Census	5,874,429
Population Growth, 1970-1980	15.5%
Largest City, Population	Charlotte 314,447
Metro population in and around largest city	637,218
Percentage of population in rural areas	52.0
Land area in square miles	48,798
Percentage of land area in farms, 1980	37.5%
Average hourly wage for manufacturing workers, Feb. 1983	$6.60
Unemployment rate, August, 1983	7.9%
Percentage of non-agriculture workforce in manufacturing March, 1983	32.9%
Per capita income, 1982	$9,032
State and local tax collections as percentage of personal income, 1981	10.3%
High School completion rate among residents 18 and over	55.3%
Percentage of households receiving food stamps, 1981	10.4%
Retail sales per household, 1981	$11,108
Hospital costs per capita, 1981	$286
Largest industrial company, sales in 1982	R.J. Reynolds $10.9 billion
Largest bank holding company, assets in 1982	NCNB Corp. $11.6 billion

Figure 1
INDUSTRIAL EXPANSION

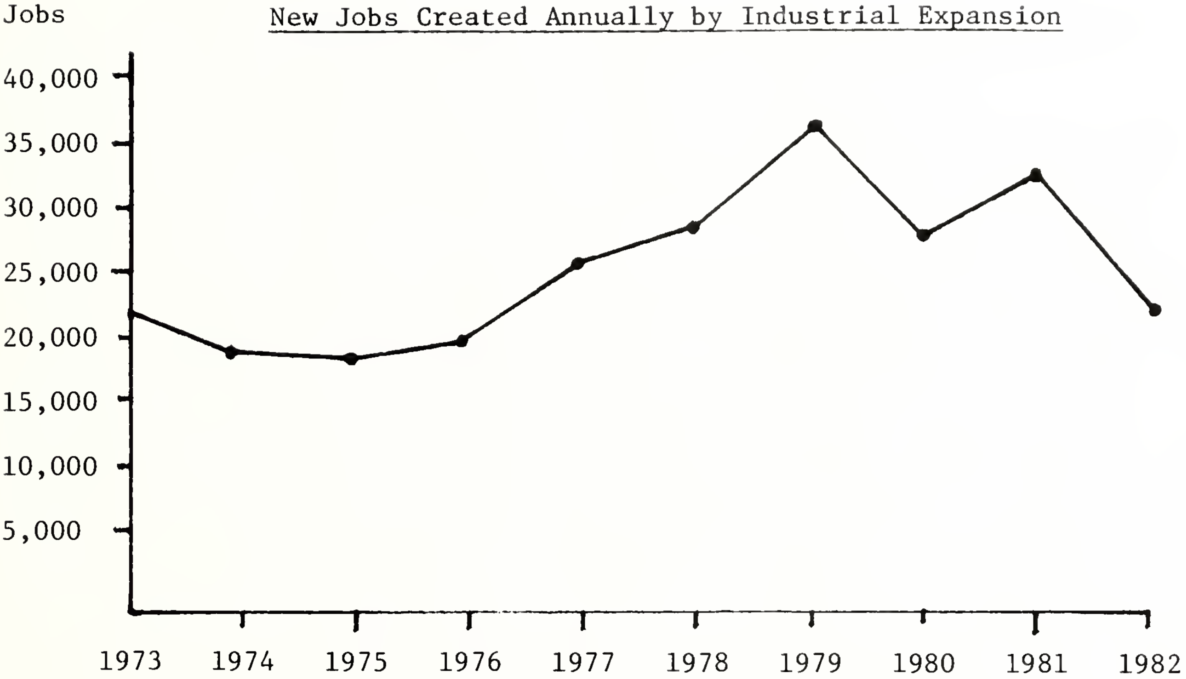
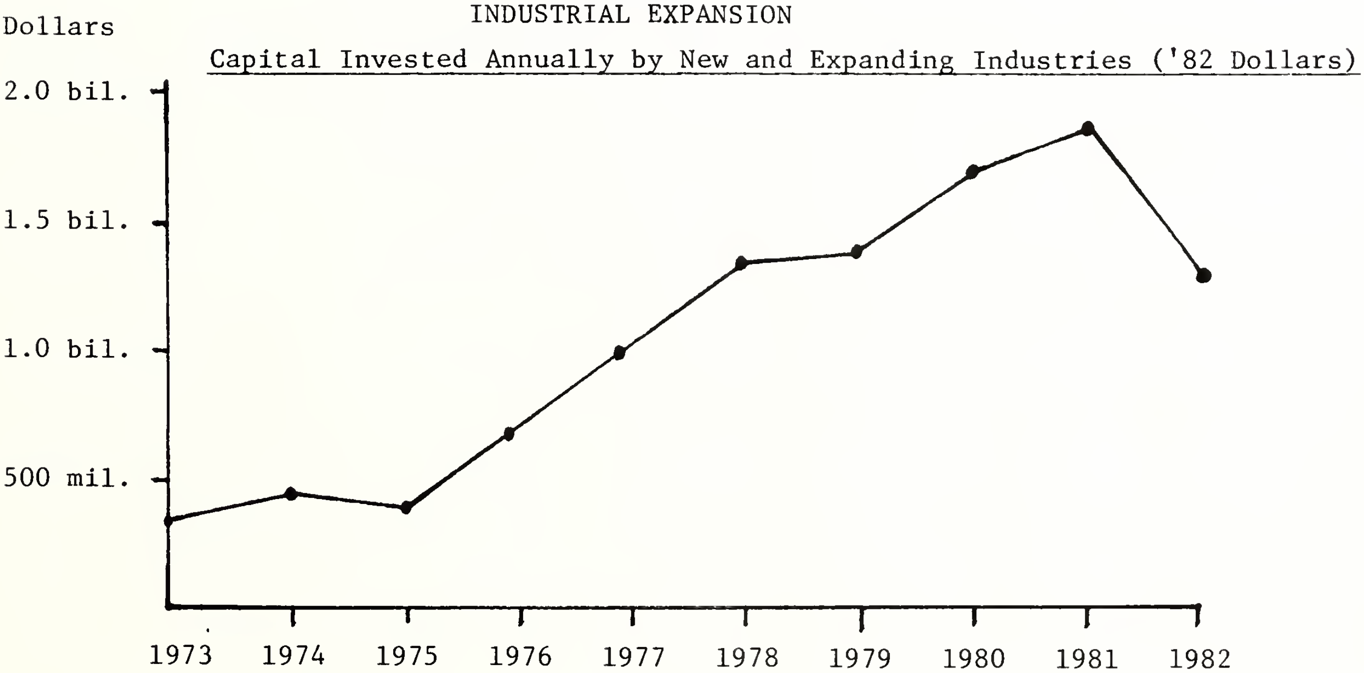


Figure 2
INDUSTRIAL EXPANSION



A NEW VISION FOR NORTH CAROLINA SOCIETY

As North Carolinians look to the future, the challenge at hand is to mobilize all the state's resources to remain at the cutting edge of change, to realize the potential of technological innovation and thereby create more and better jobs and improve the quality of life for all citizens. To achieve these ends -- to confront the transformation head on and to cope with new economic and social challenges -- requires a statewide strategy with clearly articulated programs and processes. This strategy involves the establishment of new partnerships, with business, government and academia working together, investing in stronger economic and social development.

As partners working toward common goals -- economic growth, more and better jobs, improved human welfare, preservation of environmental quality -- these institutions and organizations are obligated to evaluate the various needs and strengths within our social and economic systems. This requires developing programs and policies intended to capitalize on these strengths and correct the deficiencies. It requires investments in five broad-based, far-reaching elements which lead to social and economic well-being for the state: technological innovation, the current labor force, future human resources, ecological balance, and the public infrastructure.

Investing in Technological Innovation

The state's ability to compete successfully in national and international markets, and thereby create more and better jobs, will depend on our continued discovery and development of more efficient and productive ways of doing things. Industry will have to invest in new equipment. Government, academia and business must make substantial investments in basic and applied research and development, and work together to retool the industrial workplace with the latest technological processes. Specifically this includes:

- Providing an environment in which the entrepreneurial spirit can be nurtured, so that new ideas can be developed and tested, and where these ideas eventually mature into useful products and services;

- Upgrading research and education equipment in the state's colleges and universities, where much of the "state-of-the-art" research is conducted;

- Fostering an environment in which business and education institutions can work together on research programs in fields at the frontiers of science, such as microelectronics and biotechnology. Joint efforts by academic institutions and industries in technological innovation can benefit both organizations when properly executed.

- Promoting a reorganization of the workplace, whereby service and manufacturing processes are based on the work of an innovative, adaptable labor force and on an organization which is more flexible and less hierarchical. Managers and laborers must be trained to adapt to changing demands and conditions, and not remain locked into traditional, inflexible ways of conducting business.

Such joint investments have proven their value to North Carolina's economy in times past. In 1977, for example, North Carolina tobacco was racked by blue mold disease. There seemed to be no means for controlling the blight, and some counties lost 60 percent of their tobacco. Through the combined efforts of individual farmers, the agribusiness community, the State Department of Agriculture, and the N.C. State University Agricultural Research Service, a fungicide was quickly tested, registered for use and made available to farmers to control blue mold. Urgent attention to the problem may have rescued North Carolina's tobacco crop from potential devastation. Such a partnership can be successful as a proactive measure as well as in response to a crisis. Flexibility, innovation and cooperation among individuals and institutions, each with important contributions to solving complex problems, hold the key to innovation, increased quality, and improved productivity in the workplace.

Investing in the Labor Force

Upgrading industrial plants with new equipment and supplies is only part of the strategy. Assuring that we have a skilled workforce that can make productive use of new technologies is critical. This will require investments to strengthen our colleges, universities, and community colleges, which provide the brainpower behind both the development and the use of new technologies. Just as we retool the physical plant, so must we retool the minds and hands of our labor force and our managers by training them in the most advanced, most efficient techniques. This includes:

- Making the maximum use of all available resources -- community colleges, colleges and universities, and other institutions -- to provide training and retraining opportunities for all workers at all skill levels in every part of the state.

- Restructuring our business schools so that future managers are exposed to techniques which foster innovation, cooperation, and coordination, not just short-term profit and gain.

- Substantially improving the resources within our institutions of higher education: upgrading faculty, attracting and retaining high quality graduate students, updating course curricula, and providing access to state-of-the-art scientific equipment and facilities.

- Providing incentives to establish joint college and university-industry training programs on a sustained basis. Both industry and academia stand to gain from carefully conceived, properly established arrangements.

North Carolina has many opportunities to upgrade the skills of its labor force to account for changing labor market conditions, and the state is obligated to take full advantage of all its institutional resources to address this complex matter. The Department of Community Colleges has been given lead responsibility by the Governor for developing and implementing training and retraining programs. The new federal Job Training Partnerships Act, coordinated by the State Department of Natural Resources and Community Development, provides federal funds to be matched with state resources to retrain displaced workers through the community college system and other institutional arrangements. Some private industries are also developing innovative means to retrain workers who may be displaced by new technologies. The point is that worker displacement may be the most serious challenge to those seeking to ensure that technological innovation is used for the benefit of society rather than its disruption. Government, business and education must pool all their resources to confront this challenge.

Investing in Future Human Resources

Economic growth depends most on talented human resources. Our elementary and secondary schools have a responsibility to prepare persons to be creative -- to perceive the complexity of a situation and then move ahead with an appropriate response. In a technology-based economy, students will need more exposure to quality science and mathematics instruction. At the same time, though, our schools must better educate students in problem-solving, reasoning, reading, speaking and listening. If our schools are successful, graduating students will be flexible enough to react to the demands of a changing economy, so that in the future they can continuously learn new skills as their jobs change. Furthermore, students will be prepared to function effectively in various roles within society, with a sense of purpose and personal fulfillment. Specifically our elementary and secondary schools must:

- Raise the standards of achievement for every student and teacher at every grade level, and then provide sufficient resources to enable students and teachers to meet these higher standards.

- Upgrade the quality of science and mathematics education for the advanced student who plans a career in a technical field. At the same time, develop programs which substantially increase the technical literacy of every student, for a responsible citizen must have at least some basic understanding of the impact of science on society.

- Create an ethic of educational excellence which promotes an active role in the educational process for persons from every part of the local community -- parents, schools, businesses, governments, and others. Until citizens more clearly see the relationships between education, economic growth and an improved quality of life, there will not be the sustained commitment to educational excellence a healthy society requires.

In North Carolina, local partnerships to improve elementary and secondary education have taken on many forms. One is the Region "O" Council for the Advancement of Minorities in Engineering (ROCAME), which was formed in 1979 by representatives from school systems and industries in the Wilmington area. More than 300 minority students in five school systems have participated in the program, which involves field trips, academic and career counseling, special summer workshops, competition in science and mathematics, and summer employment in technical jobs. In addition, programs are provided for parents and teachers of ROCAME students. This and other types of partnership programs developed and implemented at the local level hold the key to strengthening elementary and secondary education.

Investing in Ecological Balance

North Carolina's most valuable resource, after its people, is a clean, healthy environment. North Carolinians respect their tradition of maintaining the beauty of the scenic mountains, the serenity of a fragile coastline, and the sanctity of clean air and water. Two broad responsibilities stand out as most overriding:

- Ensuring that economic growth and productivity can be pursued without threatening the quality of the environment;

- Using advances in science and technology to better protect the environment through, for example, controlled wastes, improved water management, controlled soil and sand erosion, and less harmful mining processes.

North Carolina's Pollution Prevention Pays program is the state's response to those who argue that industry and government can never come to terms with a balance between profit and environmental quality. In Spring 1983, workshops held at UNC-Charlotte and N.C. State University provided the stimulus to cause electroplating industry representatives to work with university scientists in seeking better ways to recover waste metal and chemicals, which up to now have been simply "dumped" back into the environment. Once these wastes have been recovered many can be recycled, and some can be sold for profit. Joint ventures to recover hazardous substances before they pose a threat to public health can be promoted across many industrial fields.

Investing in the Public Infrastructure

Good roads, safe bridges, efficient water and sewer systems are all integral yet often overlooked parts of economic vitality. At present, however, the state is suffering from the same fate as the entire nation -- insufficient investments over the years in this public infrastructure. In North Carolina there are several steps we can take to improve our public infrastructure and thereby boost our opportunity for economic growth, including:

- Applying the latest technological advances to repair deteriorating highways, bridges and other public facilities. More than one-third of the state's nearly 15,000 bridges are classified as structurally deficient, and another one-third as functionally obsolete.

- Conducting a more thorough assessment of our water and sewer systems. In some cities in North Carolina, a greater percentage of the water supply may be conserved by the adoption of new technologies in this area.

- Considering the development of mass transit projects which conserve fuel and increase public convenience.

Achieving these goals requires application of the fruits of technological innovation -- building on a strong education, training and research base, investing in new, viable and sometimes high-risk ventures, and then developing and promoting an idea, concept, service or product so that ultimately it benefits all of society. In North Carolina we are seeking to create a climate in which technological innovation can be fostered, in which all men and women with talents and ideas are encouraged and supported -- whether they are in elementary and secondary schools, higher education institutions, in a large or small business, or simply tinkering in their basement.

Our aim is to create an environment which supports people, but also pushes them as they work an idea through all of its stages until it matures. For the youngest minds that means providing a challenge at every level of education, so that the spirit of inquiry that is nurtured during the first field trip to the North Carolina Zoo continues to blossom through to the discovery, maybe 20 years later, of the fundamental make-up of genetic material. For others, such as the tinkerers who may have been swept up by entrepreneurial ingenuity, this means providing the proper combination of research and technical support, managerial assistance and financial aid to enable them to carry their idea through to its production stage. For all of us, this means creating incentives to move ahead and tackle the most pressing challenges -- in the classroom, the laboratory, the board room, the shop floor, and the halls of government.

THE ROLE OF GOVERNMENT

Society is built from the bottom up, and it is best changed from the bottom up. For example, the United States can try to strengthen public education by simply proposing a new, multi-billion dollar strategy at the federal level. But it will be far more effective to bring parents and other citizens into the schools to see the needs and to work for changes at local and state levels. That is the approach required in North Carolina.

It is at the local level -- the foundation of society -- where the most meaningful changes are made, and that is where people participate most effectively in decisions to change or not to change. To try to order or impose changes from outside ignores the need for people to participate in decisions. That influence from outside must work as a catalyst, stimulating and guiding, but not forcing or imposing.

Fostering effective and expeditious use of scientific and engineering resources in relation to the civilian economy of our nation is the role of state governments. National security, space exploration, economic stability and funding for basic research are among the responsibilities that must continue to rest with the federal government. But the partnership relations among industry, universities and government, relations essential to innovative institutional development and economic growth, are best fostered at state and local levels of government.

Elementary and secondary education systems and community colleges are almost entirely the responsibility of state and local governments. Industrial firms, farms, banks, wholesale and retail outlets, transportation systems, and all other forms of economic activity exist and function within state boundaries and relate closely to state and local governments. These units of government are the prime points of contact with respect to locational issues, labor relations, environmental management, provision of capital, living conditions for employees, and other facets of economic activity that entail industry-government interaction. Clearly, to make full and effective use of the scientific and technological resources in the state in meeting the important needs and desires of people requires cooperation and dedication among all sectors and levels of society, and state and local governments can and should help facilitate this.

The Decision-Making Process

State and local government boards, commissions and task forces will find it necessary to broaden their membership to include individuals from outside the "normal" government community. Business, labor and higher education must have significant input into policy decisions in elementary and secondary education. Scientists and humanists have important roles in public policy matters related to society in general and the economy in particular. For example, decisions with respect to revitalizing a decaying downtown area or modernizing an industrial plant are frequently made by individuals with strong political or commercial interests. The Task Force believes better decisions would result from additional input from humanists and scientists who may have studied the issues and considered a broad array of social and cultural issues, not only economic or political matters.

Traditionally, two principal spheres of decision-making in matters affecting citizens have been politics and the marketplace. The partnership of business and government is not a new phenomenon; it is, however, receiving a new impetus in the present economic and political climate. For example, while government efforts to recruit industry and pursue other joint endeavors are not directly accountable through the political process, it is generally assumed that because people need jobs, government has a mandate to create more jobs and can do this through private sector development. In that partnership, however, there is some risk that the goal of "job creation" may be too narrow in relation to overall societal goals. In this and other kinds of overlap between government and business, important considerations may be ignored. The various attempts to incorporate values, ethics and long-term perspectives into decision-making, while done with the best of intentions, may fail in the pressure of the moment. Value questions could be overlooked in favor of technical, short-term and profit-oriented considerations. What is required is more independent, broad-gauged quality of judgement brought to bear on what may appear to be simply economic or technical decisions.

The best way to ensure that such considerations are included in the political process of decision-making is to institutionalize procedures that involve a broad spectrum of informed and concerned citizens. Political representation is needed that provides a proper balance between opportunity and privilege, long-range goals and short-range preferences, human rights and majority or state interests, public interest and special interests.

The need is not to bypass but to supplement "politics as usual" in order to improve the process, representative character and quality of policy-making.

State and local government officials have become increasingly aware of the interrelationships among a variety of public policy issues. As they carry on their debates, governmental institutions will find it advantageous to broaden their vision to encompass more than simply economic issues. For example, as a greater percentage of our population becomes senior citizens, new strains on our economic and social structures will occur. Economically, it may be unwise to fail to make productive use of a workforce of capable citizens over 65. Socially, the family structure may be changed as more parents move into the home with their children after retirement. The point is, new issues are emerging to which the traditional decision-making processes must adapt.

NEW REQUIREMENTS FOR A NEW ERA

The Task Force has considered these and other issues and options discussed to this point under three broad headings: economic revitalization, research and higher education, and elementary and secondary education. The Task Force recognizes that, while each of the three is interrelated and all must be addressed concurrently, there are specific structural and institutional issues that must be confronted directly. The discussions in Volumes II, III and IV must be viewed as considerations of individual components of a larger system. And each component must be addressed by individuals in a variety of institutions -- governmental, business, educational, cultural and social.

Economic Revitalization and Technological Innovation

A comprehensive strategy for economic growth can be most successful if it is based on the promotion of technological innovation throughout the entire industrial base. This promotion comes in three ways -- 1) the recruitment of new business and expansion of existing firms, 2) fostering innovation in traditional industries, and 3) new small business start-up and development.

Volume II of this report lays out a comprehensive strategy for economic development in North Carolina. The basic premise of Volume II is that the state faces critical choices in its efforts to promote job creation and economic progress, choices largely determined by our responses to the challenges and opportunities of technological innovation. The strategy focuses on the three-above initiatives. Within each area, a number of financial, technical and management innovations are recommended to promote economic revitalization and job creation.

The first element, industrial recruiting and industrial expansion, requires a partnership among state government (primarily the Department of Commerce), the business community, colleges and universities, financial interests, and local governments. As partners, these organizations can coordinate recruitment efforts to account for the special needs and concerns of the particular businesses that the state is seeking to recruit. These organizations can also devise a policy of balanced growth -- recruiting new firms to all regions of the state, particularly those areas that are in greatest need of economic growth.

Volume II also sets forth the requirements for encouraging innovation in the state's existing industries. Traditional industries continue to provide the bulk of jobs and maintain economic stability in the state. Tobacco-related enterprises, for example, account for one of every 15 jobs in the state. The textile industry employs about 10 percent of all North Carolina workers. These and other traditional industries are the backbone of the state's economy, and attention must be focused on helping both management and labor adapt to the demands of a technology-based economy. Such adaptation will require new means of organizing the work place, including new roles and functions for employees at every level such that the tasks are driven by innovation and flexible processes, not traditional, stagnant modes of operation. Of course, training and retraining opportunities for workers in traditional industries must be expanded and strengthened.

The third strategy for economic growth is the startup of new small businesses throughout the state, a major focus of Volume II. Small businesses (500 or fewer employees) provide 90 percent of the jobs in North Carolina, and will continue as the state's primary source of employment in the future. Encouraging small business development requires the careful nurturing of the entrepreneurial spirit. New and innovative ideas can be fostered in the minds of the state's most talented individuals. The key is to create an environment in which such ideas can develop and take concrete form.

Research and Higher Education: Prerequisites for Social and Economic Growth

Higher education contributes to technological innovation in two fundamental ways. It educates and trains the professional workforce of tomorrow, and it provides the arena for much of our strongest research and development. Therefore, any statewide commitment to economic growth must be supported with substantial investments to upgrade the research, education, training and service components of our institutions of higher education which, in turn, will stimulate new ideas, products and services, and then new jobs.

North Carolina has long recognized the importance of higher education to the people and communities of the state. Historically, the state has devoted a significant proportion of its resources to strengthening its colleges, universities and community colleges, both public and private. The state ranks 8th in the nation in per capita appropriations for higher education, and nearly one-third of its budget is spent on higher education.

Volume III of the Task Force report recognizes this role of higher education in North Carolina's social and economic development. There is significant discussion in Volume III of the contributions our institutions of higher education can make -- through research, education and training -- to economic growth and social development. Volume III then concentrates on how to upgrade internal structures and operations of the institutions so that higher education can meet these new demands. It provides recommendations addressing the fundamentals of higher education -- students, faculty, and labor market information.

The challenge is to ensure that contributions of higher education extend beyond the ivy walls and into the whole of North Carolina society. For example, the state's research capabilities in the medical field are significant. Yet the state ranks seventh nationally in infant mortality rates. Clearly more must be done to translate basic scientific advances in the laboratory into better quality health care for North Carolina citizens. As the institutions of higher education take steps to upgrade their internal operations -- and such steps are essential -- so too must they carve out a new role for themselves in the state's social and economic systems.

Elementary and Secondary Education

The need to invest in human resources -- the knowledge, skills and attitudes of people -- is critical to ensuring just and sustained economic growth. Renewing our education systems at the elementary and secondary level is a mandate for future social and economic well-being.

Volume IV provides recommendations in four interrelated areas: teacher supply and quality, pupil enrollment and performance, curriculum and instructional resources, and innovation in education. A host of commissions and councils have raised the general call for educational improvement. This report sets forth specific strategies to achieve educational excellence, particularly in the fields of science and mathematics, and calls for action now.

As North Carolina continues its pursuit of economic growth through technological innovation, it will require a more highly-technical workforce. The entire workforce -- clerical and secretarial staff, middle managers, and chief executive officers -- has begun to recognize the need to rapidly adapt to new technologies and apply them for maximum productivity. Indeed, the fundamental assumption upon which much of Volume IV is based is that there is a clear and direct link between strong, sustained economic growth and a well-educated, technically-prepared workforce. The degree to which the elementary and secondary schools provide the necessary training in science and mathematics to all students will be a major contributing factor to the state's economic health.

There is a second, perhaps even more compelling reason for strengthening science and mathematics education at this level. An understanding of science and technology and their growing significance in everyday life is essential for all citizens. This means society's obligation extends to raising the level of scientific literacy among all citizens if each individual in North Carolina is to successfully adapt to a new technological era. The primary purpose of education is to prepare people for participation, in an enlightened and responsible way, in the life and governance of the communities and societies of which they are members. It is also a necessary function of education to prepare people for the workplace. A solid background in science and mathematics is essential for the general education of everyone, and our educational system, at all levels, must prepare people for particular occupations that require a specialized knowledge base. But however knowledgeable and skilled a person may be in some specialty, he or she will not be even a good worker without enjoying a reasonably good life, holding a worthy place in the community, and being on good terms with his or her self and society.

Long-Term Investments in Science and Technology

Recommendations presented in Volumes II through IV are considered investments in education, training, research and economic revitalization. They often require expenditures over and above outlays already being made for programs in these areas. Most expenditures would flow through the established budgetary channels of existing institutions and agencies. These investments are expected to help create more and better jobs, increase economic development, improve the well-being of the people of the state, and otherwise support attainment of the goals and objectives considered relevant by the Task Force. Because of time constraints, precise documentation of the costs of each recommendation was not possible. Expenditures necessary to fully implement the strategies set forth in Volumes II-IV will likely range from $200-$400 million annually, with at least 75 percent of those funds earmarked for strategies to strengthen elementary and secondary education. The range of expenditures is from a few thousand dollars for one-time studies of industrial development activities to more than $100 million annually for salary increases for all elementary and secondary school teachers. Many of the recommendations require no expenditure of funds, but rather a change in roles, functions or organization within certain agencies.

Businesses, foundations, civic clubs and other private organizations have indicated their willingness to make investments in programs similar to those recommended by the Task Force. These institutions recognize that the benefits they receive from such investments are long-term, but also real and substantial. New incentives are needed to encourage expansion of private sector support.

It is up to state and local governments, however, to take a strong and leading role in supporting new investments in science and technology programs. The Task Force does not prescribe a detailed strategy for generating revenues to meet these needs. Instead, the Task Force has considered several options for state and local governments and the private sector to acquire new revenues for the support of recommended programs. Those options include the following:

- Review state finance laws and create more opportunities for banks, financial institutions and other private sources to increase the availability of capital for advanced-technology firms.
- Promote the investment of accumulated pension funds in advanced-technology firms. The state employee retirement system, the public school retirement system, and other pension boards could be given authority to use small fractions of their portfolios for investing in new-technology economic development activities.
- Provide incentives encouraging firms to invest in research and development, such as investment credits for firms which acquire certain assets, or incentives encouraging corporations to loan equipment or personnel to educational institutions.
- Provide economic incentives to businesses which hire students and faculty to work in their laboratories on a part-time basis.
- Most essentially, place a high priority on the use of new and existing revenues to implement the recommendations. Such revenues may be acquired through the transfer of funds out of current programs, or through new taxes or tax increases.

Regardless of the source of funds, the investments required to carry out programs for strengthening education, training, research and economic growth are substantial. So, too, will be the returns. Other states and nations have begun to make similar investments and have realized substantial returns. Expenditures on research and development in agriculture and forestry in the United States over many years have been shown to generate an average annual return of 20 to 170 percent. The point is that, while it is not possible to draw explicit linkages between tax dollars invested in technological innovations and returns such as new jobs and higher SAT scores, it is clear that such investments have significant payback. No state or nation can compete in international markets today without such investments. The paybacks will be long-term, and many cannot be quantified. They are real, however, and their benefits can potentially be realized by every citizen in North Carolina.

CONCLUSION

The degree to which North Carolina succeeds in improving the social and economic well-being of all citizens depends to a large extent on the way it plans for and manages its scientific, engineering and technological opportunities. This process involves more than economic development or industrial recruitment. It involves upgrading our research capabilities, including better scientific equipment and facilities as well as more proficient researchers. It means encouraging the adoption of new techniques in the workplace to increase productivity and improve efficiency, while simultaneously providing adequate training and retraining opportunities for workers displaced by new technologies. It includes devising new means for advancing research in medical care and treatment, as well as developing new systems which ensure better health care delivery to all our citizens. It means improving the quality of science and mathematics education at all levels of schooling, while maintaining a course curriculum which provides for a balanced liberal education. It involves building an economic climate which attracts new high technology industries to the state, while preserving the integrity of the environment. In short, it means using the powers of science to enable every citizen to improve the quality of his or her own life and lives of others.

The Task Force urges other organizations and institutions in and out of government to conduct intense studies of the issues not fully addressed by these volumes -- especially environmental management, health and medical care, transportation, care for the elderly, and the cultural aspects of the transformation taking place.

Through successful working partnerships among government, business, academia and people, North Carolina can adopt and manage the technical and organizational innovations that will help us achieve a healthy society. As we decide, as a state, how and for what purpose the power of science should be used, we decide a great deal about our social and economic well-being.